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POLICY STATEMENTS ON THE DEFENSE IN-HOUSE LABORATORIES

1 JULY 1966

Management Analysis Memorandum . . .

Office for Laboratory Management

Office of the Director of Defense Research and Engineering
Washington, D.C.

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Management Analysis Memorandum 66-2

of the

Office for Laboratory Management
Office of the Director of Defense Research and Engineering
Washington, D.C. 20301

Approved for publication:

Assistant Director (Laboratory Management)
Office of the Deputy Director (Research and Technology)

FOREWORD

In June 1966, the policies, roles and purposes of the Department of Defense in-house laboratories were the subject of two important addresses, one by the Honorable John S. Foster, Jr., Director of Defense Research and Engineering, at the Fifth Army Science Conference, West Point; and the other by Dr. Finn J. Larsen, Principal Deputy Director of Defense Research and Engineering, before the Aerospace and Science Technology Branch, Scientific Research Society of America (RESA), at Bolling Air Force Base.

These statements represent current thinking at the policy level in the Department of Defense (DoD) and may have important, long-term implications relative to the future character and position of the in-house laboratories. They are published as a Management Analysis Memorandum in order to inform all the DoD's in-house laboratories of the thoughts expressed here by Dr. Foster and Dr. Larsen.

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Remarks to the Fifth Army Science Conference at West Point, New York, 16 June 1966

by

The Honorable John S. Foster, Jr.
Director of Defense Research and Engineering

It is a great pleasure to be able to talk to this group today at your Fifth Army Science Conference.

My agenda tonight is really very simple. I want to discuss with you the meaning of in-house technical organizations within the context of our overall research and development (R&D) effort. In particular I would like to place special emphasis on Southeast Asia, on the one hand, and on "assured destruction" programs at the other end of the spectrum.

The Department of Defense's mission is national security. It must provide the operational forces with superior weapons, ordnance and techniques that will anticipate any foreseeable threat. This is a reasonably challenging job. It takes all kinds of resources, capabilities and contributions. This mission is heavily dependent upon science and technology, which gives real meaning to both your and my efforts. It also takes the support of all types of organizations—university, industry, nonprofit and in-house organizations. Each of these organizational types has a relatively unique, although not mutually exclusive role to play.

We have an array of 143 Defense in-house technical organizations, with coverage of most of the relevant technical areas. They vary widely in strength, to as high as 7,000 people. They vary in size from 10,000 square feet to 5,000,000 acres. The total institutional complex represents an investment of $4.1 billion in property, housed in 103 million square feet of building space on 10.6 million acres of land. The total dollar flow from all sources through these organizations was $3.7 billion in FY 1965, of which $1.7 billion was for in-house programs.

These organizations carry out a wide variety of functions—which makes it very difficult to generalize meaningfully about their role. Let me try to convey to you what I think is the purpose of our in-house technical organizations.

I see the in-house labs as applied science laboratories—applied <u>military</u> science laboratories. This is their unique difference from big university and industrial laboratories. There tends to be a dearth of good applied scientists. The pure scientist usually doesn't want to get involved directly in our kind of problems. The laboratories provide the scientific and technical base for the U.S. Military Services.

Our most important asset in the labs is PEOPLE—dedicated professionals whose careers are commited to the development of systems and weapons of the operational forces. The people uniquely provide continuity and integration in what would otherwise be a highly fragmented pattern of discontinuous and heterogeneous contributions to the desired end. The devoted scientists and engineers who man these laboratories as a life-long career provide the best random-access memory for the bottomless data bank into which we are pouring torrents of unrelated facts. These

are the people who are our professionals over the years and really carry us through the "lean years." When the chips are down, they are there to get things done well and in a hurry—minimum reaction time.

Second, the DoD laboratories serve as interpreters in translating projected military requirements into technological goals and experimental prototypes. A stated military requirement can frequently be satisfied by three or four alternative technical approaches, and it may be necessary to sponsor several exploratory development programs in parallel to make sure that the costly engineering-development eggs are placed in the one right basket that combines feasibility with cost effectiveness and operational reliability.

Third, a unique characteristic is that the government laboratories have a powerful lever to magnify their effectiveness. They plan, however, and evaluate the larger portion of our research and technology programs that is contracted to industrial and university laboratories. Intelligent contract definition and project guidance can save many millions of dollars and ensure the timely forging of critical links in the weapon-systems chain.

The in-house laboratories must play a key role in shaping and administering the complex research, development, test and evaluation (RDT&E) program on which our defense posture so heavily depends. The role of laboratories in the development and management of large weapon-system development and test programs, although quite variable, is another function which ensures that lessons of the past will be reflected in current and future operational equipment.

Up to now I have been talking in the abstract, telling you things that you have heard many times before. Let me add some flesh and blood to the skeleton I have just sketched for you.

When I first arrived, Mr. McNamara told me that he saw two main challenges to the United States and wanted me to pay special attention to:

(1) the maintenance of an "assured destruction" capability and

(2) the war in Southeast Asia.

I recently visited Southeast Asia for the purpose of seeing how effective the last 10 to 20 years of R&D have been; what quick fixes are needed; and what R&D programs for systems are needed in the next 10 to 20 years.

You know, it was an awesome and inspiring experience, this view of our forces in action halfway around the world. What a magnificent job they are doing—a first-rate job with first-rate equipment. I was impressed by the modern thinking among the commanders. They realize they are fighting a new and special kind of war. They are anxious to innovate with new tactics and equipment. Both Admiral Sharp and General Westmoreland want personal scientific advisers on their staffs.

But it's a cruel war, a difficult, complicated, awkward war. It is quite different from the way we fought in the past, yet it may be typical of what we can expect during the next 10 to 20 years.

Because of your interests, I would like to give you my impressions of two areas tonight—land warfare and counterinfiltration.

Land Warfare

There is an enormous imbalance between forces. We are the best equipped force in the world, fignting one of the worst. We are in the open and operating from concentrated bases, and they are spread over the countryside. We are 9000 miles from home in unfamiliar terrain. The proof of our success is that we are on the offensive all over Vietnam. There has been a big change in one year.

The enemy is in hiding. Our one overwhelming problem is finding and fixing the enemy, spread out over huge areas of "guerilla-absorbent" terrain. We just don't have the sensors and detectors to make it easy to find him. We are still using the eyes and ears of foot patrols and FAC (forward air controller) aircraft spotters. While he is exploiting nature to work on his behalf, we must find a way to use technology to strip this basic advantage from him.

When we find the enemy, we have overwhelming advantage in mobility, firepower, communications and logistics. The helicopter has virtually revolutionized combat tactics. I am proud and thankful that we had the 1st Cavalry Division ready when we needed it. Practically everything they use is new since Korea. In a classic war, a division might fight over an area of 400 square miles. In this war, coverage of 10,000 square miles is possible. They can move batallions of men or artillery anywhere in that area in one day. Thus we have seen a revolution of weapon systems in the field. We are really in the process of developing tactics which will revolutionize COIN (counterinsurgency) warfare.

But, while the more densely populated areas are now much safer, we are forcing the enemy back to guerilla tactics which make it much more difficult for us; but we are on the prowl, while he has fewer places to consolidate, train, reequip or marshal supplies in large numbers.

In the time needed, we must be able to cope with big attacks and small hit-and-run attacks, and must help in rebuilding the country. Probably the least recognized contributions of our GIs is the rebuilding. In his typical way the GI is, on his own, digging ditches, building roads, building churches, and doing everything he can to rebuild the community.

Counterinfiltration

The second area I want to discuss is counterinfiltration. The warfare capability of the VC (Vietcong) is supported by North Vietnamese infiltration. Our basic aim must be to isolate the country from infiltration, which is a major step toward pacifying the country so that civil action can take over. The level of infiltration determines the level of fighting and of total costs in men, materiel and money.

We are concerned with land trails, rivers and the sea. We have had to resort to an interdiction campaign to cut down the southward flow of supplies from North Vietnam. Very close coordination is needed between reconnaissance, intelligence interpretation, and prompt reaction strikes. We know we are hurting him but, so far, not enough to stop him.

Their resupply system is like an enormous group of ants. Individuals, carrying small loads along multiple routes, never seem to stop moving for very long. They show enormous capability to repair routes and bridges, and they always seem to be able to find alternate routes readily. We have to hit the supplies and vehicles directly.

Trail interdiction requires all new kinds of systems. We require new concepts in real-time reconnaissance and immediate strike. The weather, terrain, and foliage cover are all against us. New gadgets and systems still hold out hope of additional pinching of resupply. Posts along the border can monitor but not inhibit infiltration at this time, but systems and concepts are beginning to be understood which may be of considerable help.

Stopping infiltration by sea and up rivers is even more difficult since there is a huge natural flow and water is a prime means of national transport and income. We have to patrol about 400 miles of coastline, 400 miles of main arteries and about 4000 miles of tributaries.

Again, we need sensors and detectors of contraband goods and for distinguishing the good guys from the bad.

So counterinfiltration is again the process of fragmenting resupply routes, and attrition of supplies—first down through North Vietnam, then along trails and coastlines, and finally along borders themselves. The basic problem is finding the stuff and the vehicles (or porters) in real time en route at any time of day or night in any weather.

Summary

Well, what have I really been trying to tell you? The military forces are performing a great job. Where they are limited, we can generally trace it back to unfinished or ignored R&D.

A major problem is sensors. A great deal of understanding and work is needed here. We must develop better means of finding guerillas, sites and enemy aircraft flying over. We must improve our ordnance to be selective and to work in difficult terrain. We must develop whole new police and patrol-type systems that can work around the clock every day. We must continue to develop VTOL (vertical takeoff and landing) for flexibility of movement and rescue. We must remove the power of nature from the guerilla. And we must continue to develop means of fighting and policing that minimize the number of ground forces permanently committed. The list is almost endless. A major advance in these capabilities, in my opinion, could change the war.

These problems are your problems. The in-house labs must lead the way in quickly providing new modifications, new systems and new capabilities. I am convinced that solutions tend to evolve when you get a creative group of guys together with common objectives, a lot of flexibility, a high degree of local autonomy and lots of interaction with the operational people.

These problems are a challenge to in-house labs, to Army R&D and to western science. Under the right conditions and management, answers and solutions will emerge.

I would like to close with a thought expressed by Admiral Mahan in his book, The Influence of Seapower Upon History, 1660-1783. Because of the impression this observation made upon me nine years ago, I have carried it in my pocket since then.

> The battles of the past succeeded or failed according as they were fought in conformity with the principles of war; and the seaman who carefully studies the causes of success or failure will not only detect and gradually assimilate these principles, but will also acquire increased aptitude in applying them to the tactical use of the ships and weapons of his own day. He will observe also that changes of tactics have not only taken place after changes in weapons, which necessarily is the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement of weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change, by careful study of the powers and limitations of the new ship or weapon, and by a consequent adaptation of the method of using it to the qualities it possesses, which will constitute its tactics. History shows that it is vain to hope that military men generally will be at the pains to do this, but that the one who does will go into battle with a great advantage—a lesson in itself of no mean value.[1]

[1]Alfred Thayer Mahan, The Influence of Seapower upon History, 1660-1783, Boston: Little, Brown and Company, 1918, pp. 8-10.

Role of the Military Laboratory

Address before the Aerospace and Science Technology Branch,
Scientific Research Society of America
Bolling Air Force Base, Washington, D.C., 24 June 1966

by

Dr. Finn J. Larsen
Principal Deputy Director of Defense Research and Engineering

General Demler, Colonel Hearn, members of the Aerospace and Science Technology Branch of RESA:

One of the major advantages of professional societies like RESA is the way in which they cut across formal command structures. I welcome the opportunity to address the Aerospace and Science Technology Branch today for two reasons: It gives me a chance to meet the managers of Air Force research and development, and it gives me a chance to reassure you that we in ODDR&E[2] are not necessarily issued horns and a tail along with our water carafes.

The problems I'd like to talk about today are those of the in-house laboratories. Dr. Foster, in a keynote address before the recent Fifth Army Science Conference at West Point, discussed the question of the role of the in-house labs as seen from a policy level.

There are 143 in-house RDT&E organizations, and it is difficult to make any valid generalization applicable to all of them. Nevertheless, he found that these laboratories share four common characteristics: First,

> ...PEOPLE—dedicated professionals whose careers are commited to the development of systems and weapons of the operational forces. The people uniquely provide continuity and integration in what would otherwise be a highly fragmented pattern of discontinuous and heterogeneous contributions to the desired end. The devoted scientists and engineers who man these laboratories as a life-long career provide the best random-access memory for the bottomless data bank into which we are pouring torrents of unrelated facts. These are the people who are our professionals over the years and really carry us through the "lean years." When the chips are down, they are there to get things done well and in a hurry—minimum reaction time.
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> Second, the DoD laboratories serve as interpreters in translating projected military requirements into technological goals and experimental prototypes. A stated military requirement can frequently be satisfied by three or four alternative technical approaches, and it may be necessary to sponsor several exploratory development programs in parallel to make sure that the costly engineering-development eggs are placed in the one right basket that combines feasibility with cost effectiveness and operational reliability.

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[2]Office of the Director of Defense Research and Engineering.

Third, a unique characteristic is that the government laboratories have a powerful lever to magnify their effectiveness. They plan, however, and evaluate the larger portion of our research and technology programs that is contracted to industrial and university laboratories. Intelligent contract definition and project guidance can save many millions of dollars and ensure the timely forging of critical links in the weapon-systems chain.

The in-house laboratories must play a key role in shaping and administering the complex research, development, test and evaluation (RDT&E) program on which our defense posture so heavily depends. The role of laboratories in the development and management of large weapon-system development and test programs, although quite variable, is another function which ensures that lessons of the past will be reflected in current and future operational equipment.

Since coming to the Department of Defense, both Dr. Foster and I have made the understanding of the in-house laboratories and technical organizations a high-priority item. We have been concerned with their health and effectiveness. We have the strong support of Secretary McNamara. We believe that these in-house institutions represent an important resource that can well determine our future for decades to come.

It is possible for laboratories to fail for the lack of a meaningful mission. While this is a serious problem, a more tragic situation is when missions fail because of the lack of a lab.

Since last November, we have been working closely with the Assistant Secretaries (R&D) to develop a specific and comprehensive plan of action which would be directly responsive, not only to the urgent and high-priority Southeast Asia problems, but also to other critical military problems which may in the future supplant Southeast Asia in urgency. While I don't believe there can be a simple, universal solution to all problems, I know that solutions evolve when a creative group of people with common objectives, a great deal of flexibility, a minimum of mission barriers, a high degree of local autonomy, and continuing interaction with the operational side of the house are brought together. Better answers may come from the creation of lead laboratories or technical centers that are responsible for, and capable of, carrying a problem from the underlying research to a military solution in the form of an advanced weapon or a whole new system concept, without having to pass the ball (or buck) from organization to organization. This does not mean that the laboratories as they now exist have not played, or are not playing, a vital role today. The question, rather, is whether the principles of systems management—which the Air Force has done so much to develop—can be applied with equal success to the management of in-house laboratories.

The ability to focus our in-house brains and resources, together with those of universities and industry, on the most urgent military problems means that we must tailor our organizational arrangements and dynamics toward such problems. We have learned our combat lessons well, have made revolutionary and innovative changes in Southeast Asia. But we are still trying to handle some problems of the applied military sciences according to yesterday's concepts.

While plans are not complete, we expect that a 5- to 10- year plan that relates our laboratory arrangements, activities, interactions and functions directly to the long-range, high-priority military problems will evolve. While the impact of these plans will have some effect upon all of us, I believe that such planning will provide for greater contributions and more meaningful and timely solutions to our military operational problems.

After our laboratory goals are described in sufficient detail, we must fashion those flexible management tools that are unique to the RDT&E process and are essential to providing the proper technical environment, motivation and the support of creative people. Apropos of flexible management tools, the laboratory director's fund was set up to allow bright young men and bright young ideas to move rapidly—the more it is controlled, the higher the level at which control is exercised, and the more one defeats the original purpose for which it was created. The Air Force has administered the program with more rigorous control than either of the other military departments, and it is doubtful if the results achieved in the Air Force have been as good.

Speaking of bright young men leads me to the next problem I would like to discuss today—the care and feeding of bright young (and not so young) R&D officers.

I believe there is a great need for military officers with technical experience and knowledge in the military departments. It is interesting to note that the Air Force undoubtedly leads the way in terms of a progressive R&D career program for technically trained officers. Even the Air Force's fine program can be improved, and we should give even more attention to the development of an attractive career program.

The skills represented by the military scientist and engineer are an essential and dedicated part of the DoD. We owe the R&D officer much more than we have been able to give him in the past. We must let him know early in his career what his role is, where he fits in the overall scheme of things, and where he can make the greatest contributions.

Any career-progression program for R&D officers must have as one of its major goals the development of a professional officer, highly competent in the planning, development and acquisition of weapon systems and their orderly introduction into the inventory. In order to perform this vital function, there is no question that we need a unique talent, the combined background of technical and managerial training and experience, and an understanding of the Air Force's mission and its operations. In our kind of business, we can no longer separate management decisions from technical decisions. Certainly, we can't ignore the military implications of either. Many of the problems that we have in ODDR&E, such as the selection of the most appropriate development programs, cost overruns or target-date slippage, can be traced to technical decisions. Such technical decisions dominate our management actions. Technically trained people must therefore become the primary source of managers in a highly technical Air Force.

For this reason, our career programs must be systematically devised and carried out to ensure that young, competent, professional officers can contribute directly to the Air Force's R&D objectives while progressing through various phases of academic specialization, operational experience, and broadening and maturing technical experience. They must be exposed to increasing responsibility for

program supervision, technical management and decision making. The majority of these young officers will and should be motivated toward the technical management end of the spectrum, that associated with the development, testing, evaluation and acquisition of systems and hardware of the future.

I can think of no better technical training grounds than the in-house laboratories for these officers. Their early or initial assignment in the R&D field should be in RDT&E organizations such as OAR's and RTD's laboratories[3]. Laboratory assignments will permit them to learn about the R&D process and to become proficient in a particular technical specialty. That experience, plus technical schooling (including advanced degrees for the more capable), will provide an essential foundation for practically any position of responsibility in the R&D activities of the Air Force. Also, it would be a most useful background in many other activities of the Air Force.

I am hopeful that the Air Force can establish an even better career-progression program which, with laboratory training as the foundation, will create technically qualified military men with a competent knowledge of R&D specialties, a good understanding of the Air Force's management problems, and a keen awareness of operational needs and methodology. Such people are urgently needed.

Creating a career program of this kind is not a simple task. Few officers will have—nor will we want them to have—identical career patterns. Rather, any program of this type must be sufficiently flexible to accommodate to the complexity of the environment and the nature of the work with which they are associated. I believe that every officer should and must know more about the details of his personal career program, so that he can constantly adjust to it and also better prepare himself for his own future. I know that we can improve the situation if we understand its importance.

I have spent what may appear to be excessive time on the technical management careers of military officers, and I may seem to have talked of the laboratories primarily as training grounds for such officers. This is because early laboratory career opportunities are suited to the majority of R&D officers. On the other hand, I have met a few highly qualified officers who, once they had obtained advanced degrees (or at some other point in their careers), were motivated toward research and laboratory work and desired to remain in uniform. Frankly, I don't know whether we should make provision for these men as we have in the past or encourage them to join the laboratories as civilians.

Officers who fall into this type of career must recognize, however, that they will be living in an environment that is different from that normally associated with the military career and also somewhat different from that normally associated with professional scientists. It is important that those who elect such a career be carefully screened on a continuing basis to ensure that the highest standards of quality are maintained. In turn, their careers must be characterized by tenure, continuity and stability.

This discussion has concentrated mainly upon the career of the military R&D officer. It has done so because it is more complex and less understood than that of the Air Force civilian scientists and engineers. There is not, and cannot be, any

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[3]OAR—Office of Aerospace Research; RTD—Research and Technology Division.

conflict between the military and civilians. We need the talents, the background and the motivation of both. The military/civilian team that you have evolved makes the Air Force the great organization that it is. It is certainly regrettable that artificial differences exist between these members of the R&D group. The differences have no real basis, particularly since the men are working shoulder-to-shoulder to solve common problems.

I feel that much has been done to enhance the career of the civilian scientist and engineer in government, particularly in the past few years. The Honorable John Macy, Chairman of the Civil Service Commission, has continually emphasized to his people that there is no reason why we cannot provide the same environment in government laboratories that is maintained in the laboratories outside government. He maintains that, if we have not and do not, then it is because we have a serious communications gap. The laws, the regulations and procedures exist. We must begin using them more wisely and must apply them more rapidly. Experience tells me that he is essentially correct.

It is a truism, but one I think worth repeating, that the best way to have a dynamic laboratory is to give it a dynamic mission. Where in the range of research, exploratory development, advanced development, engineering development and operational systems development should the missions of the in-house laboratories be? Not too much pure research, I'm afraid—no more than in a very good industrial R&D laboratory—and the research should be concerned with an environment of military importance. And certainly not at the other end of the scale—in the design of engineering prototypes for production, since, in order to be truly effective, the designer for production has to live next door to the factory.

What does this leave for the in-house labs? One of the most exciting jobs of all. Taking new ideas and concepts wherever they may come from, and synthesizing them into future systems and components. Then, if and when the laboratory scientists' brain children do go into production, wisely monitoring production and helping the producers avoid the mistakes previously made in advanced development. If you can't find enough to do in exploratory development and advanced development, with a smattering of research thrown in to keep your activities doubly interesting, please let me know.